PAN-ARCTIC OUTLOOK – July 2012 Based on June Data
Tim Folkerts

1. Extent Projection 4.1 ± 0.3 million km^2

2. Methods/Techniques

A variety of publicly available monthly data from 1978 forward (including area, extent, volume, regional extent, NCEP Reanalysis Data, and various climate indices) was collected. For each year, monthly data up to 24 months before the September minimum extent was organized and correlated with the minimum extent. Multiple regression analysis was also performed on a variety of combinations, seeking sets of data that correlate well, while trying to avoid overfitting.

These simple regression and multiple regression results were then used to predict the minimum extent for September 2012. Several different predictions were made using different input parameters; the predictions were combined to come up with a final prediction.

This month, I added a new technique – doing multiple regression to predict the annual *change* in the extent, rather than the extent itself. The motivation was to reduce the influence of long-term trends to focus instead on what drives the change from year to year. (Overall, the predictions using this technique are similar to the predictions based on actual extent.

For July, coming up with a "consensus" predictions from the various regression results was challenging. In 2012, June records were set for lowest area, lowest volume, steepest downward slope for area, and steepest downward slope for volume. Extent was the second lowest ever. Such unusual data points can lead to unusual predictions, which was indeed the case. Extent prediction based on area and volume took a sudden jump downward from ~ 4.1 million km^2 to ~ 3.5 million km^2, while predictions based on extent and other parameters seem to be holding steady around 4.2 million km^2.

Thus we get a bimodal set of predictions, one set centered near 3.5 million km^2. The other set is centered near 4.2 million km^2. Since the lower values are very recent changes, I give more weight to the higher values, setting on 4.1 ± 0.3 million km^2 as a prediction.

More details can be found at https://sites.google.com/site/sciencestatsandstuff/sea-ice

3. Rationale

It is reasonable to assume that past conditions of the ice, the Arctic climate, and wide-area climate indices should be correlated with future ice conditions. Because these relationships can be subtle and complex, statistical models combining multiple parameters are expected to be more effective than individual monthly data at making predictions.

4. Executive Summary

This analysis is based purely on a statistical analysis of climate and ice data, using commercial statistical software. The goal was to use techniques and data available to the public.

5. Estimate of Forecast Skill (if available).

The regression models typically have R^2 values of 0.7 to 0.9 for the September minimum extent from the period 1979 – 2011, with typical RMS errors of the fits of approximately 0.25 million km^2.

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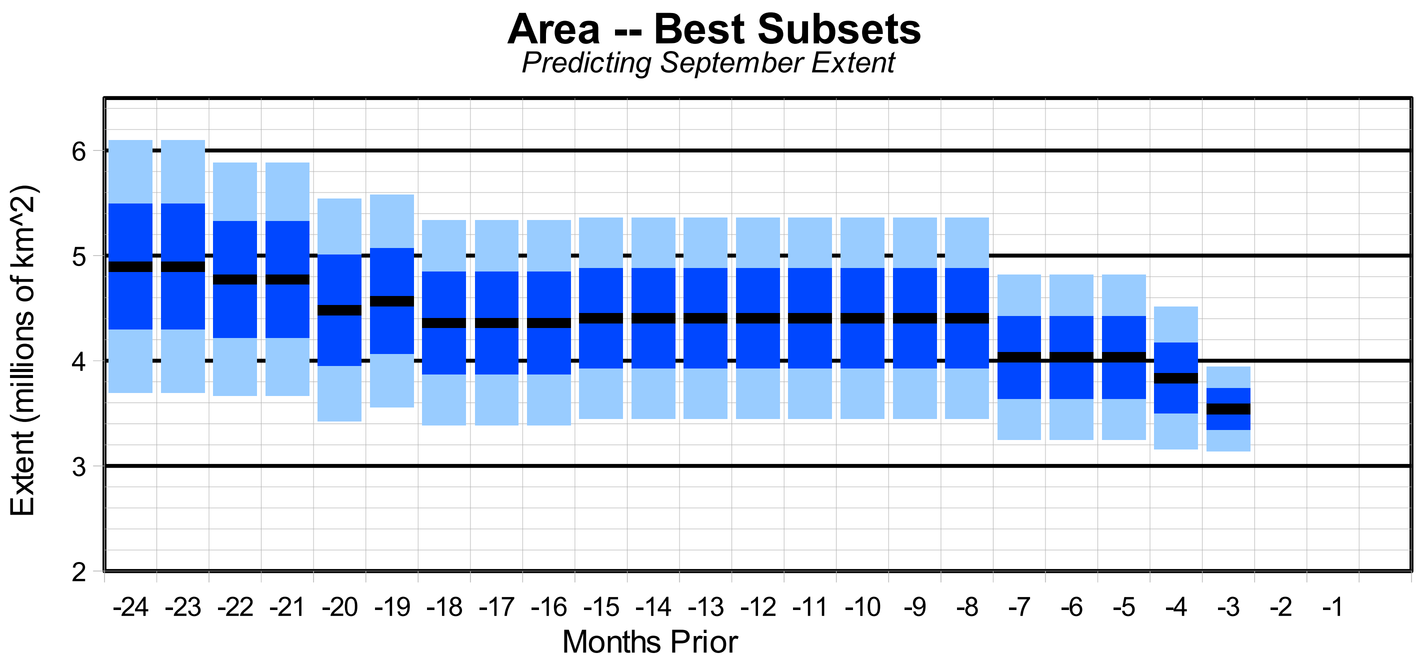
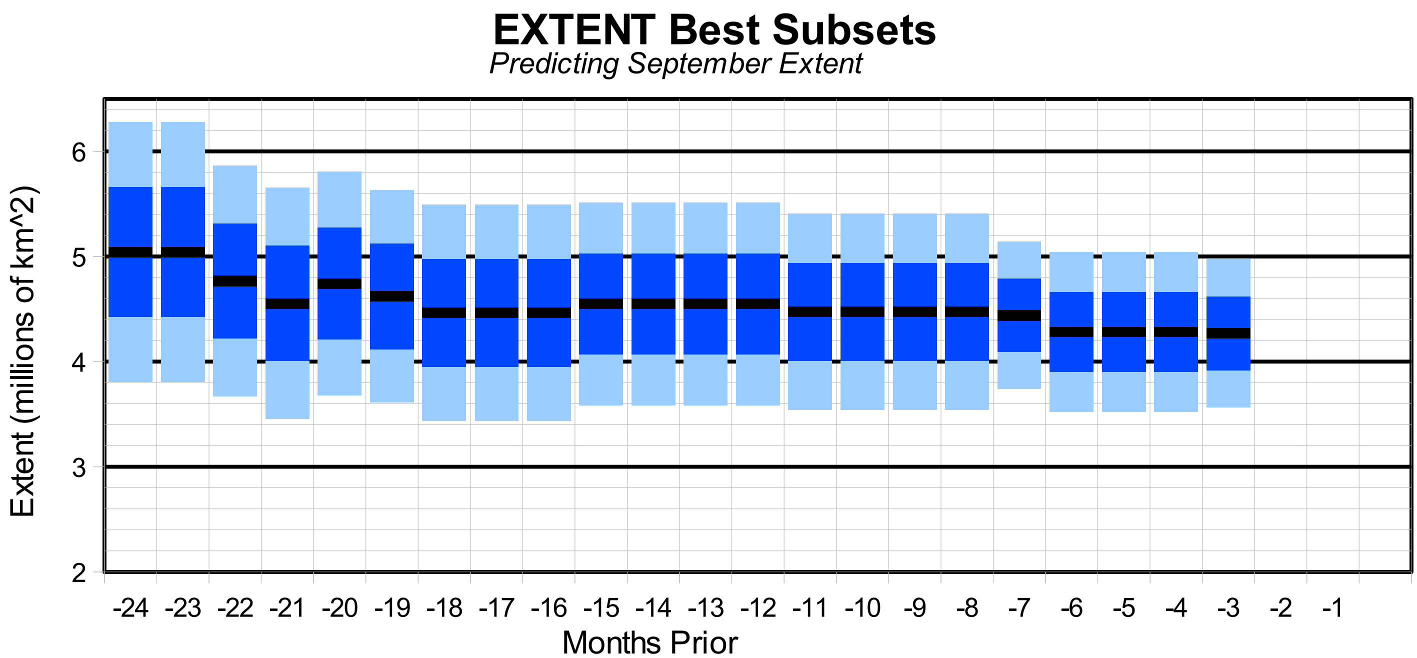


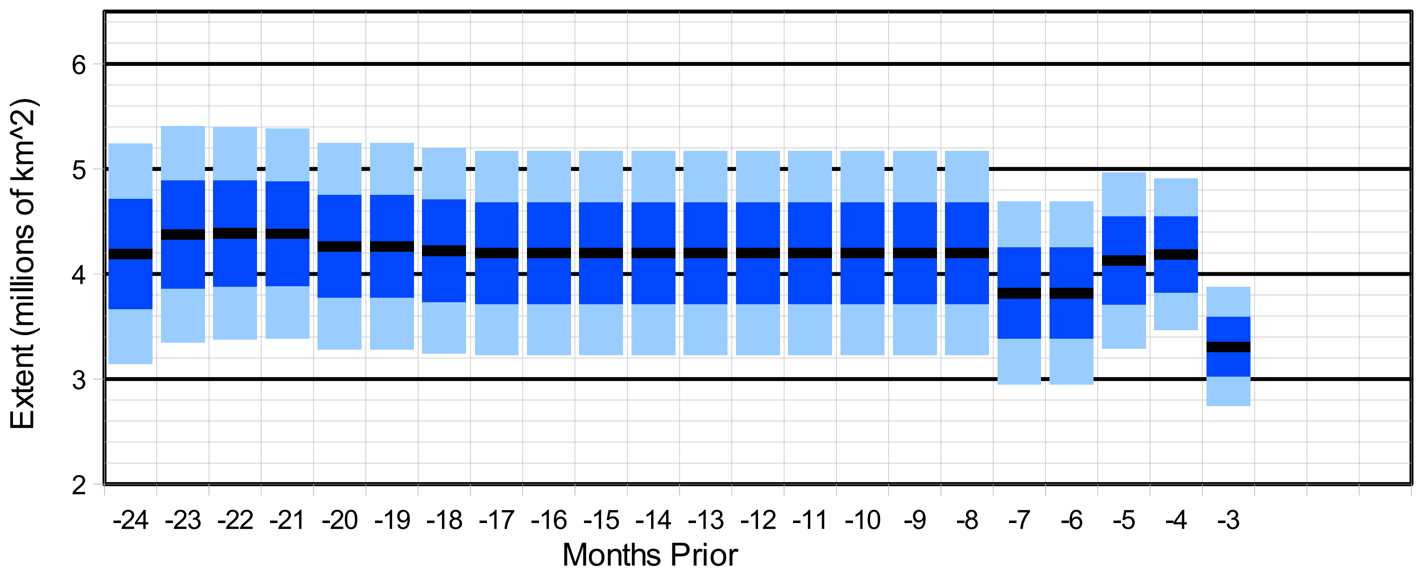
Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E	A BSS	1	-24	4.90	0.60	0.57
E	A BSS	1	-23	4.90	0.60	0.57
E	A BSS	2	-22	4.77	0.56	0.62
E	A BSS	2	-21	4.77	0.56	0.62
E	A BSS	2	-20	4.48	0.53	0.65
E	A BSS	3	-19	4.57	0.50	0.67
E	A BSS	3	-18	4.36	0.49	0.69
E	A BSS	3	-17	4.36	0.49	0.69
E	A BSS	3	-16	4.36	0.49	0.69
E	A BSS	3	-15	4.41	0.48	0.71
E	A BSS	3	-14	4.41	0.48	0.71
E	A BSS	3	-13	4.41	0.48	0.71
E	A BSS	3	-12	4.41	0.48	0.71
E	A BSS	3	-11	4.41	0.48	0.71
E	A BSS	3	-10	4.41	0.48	0.71
E	A BSS	3	-9	4.41	0.48	0.71
E	A BSS	3	-8	4.41	0.48	0.71
E	A BSS	6	-7	4.03	0.39	0.78
E	A BSS	6	-6	4.03	0.39	0.78
E	A BSS	6	-5	4.03	0.39	0.78
E	A BSS	8	-4	3.84	0.34	0.83
E	A BSS	9	-3	3.54	0.20	0.94



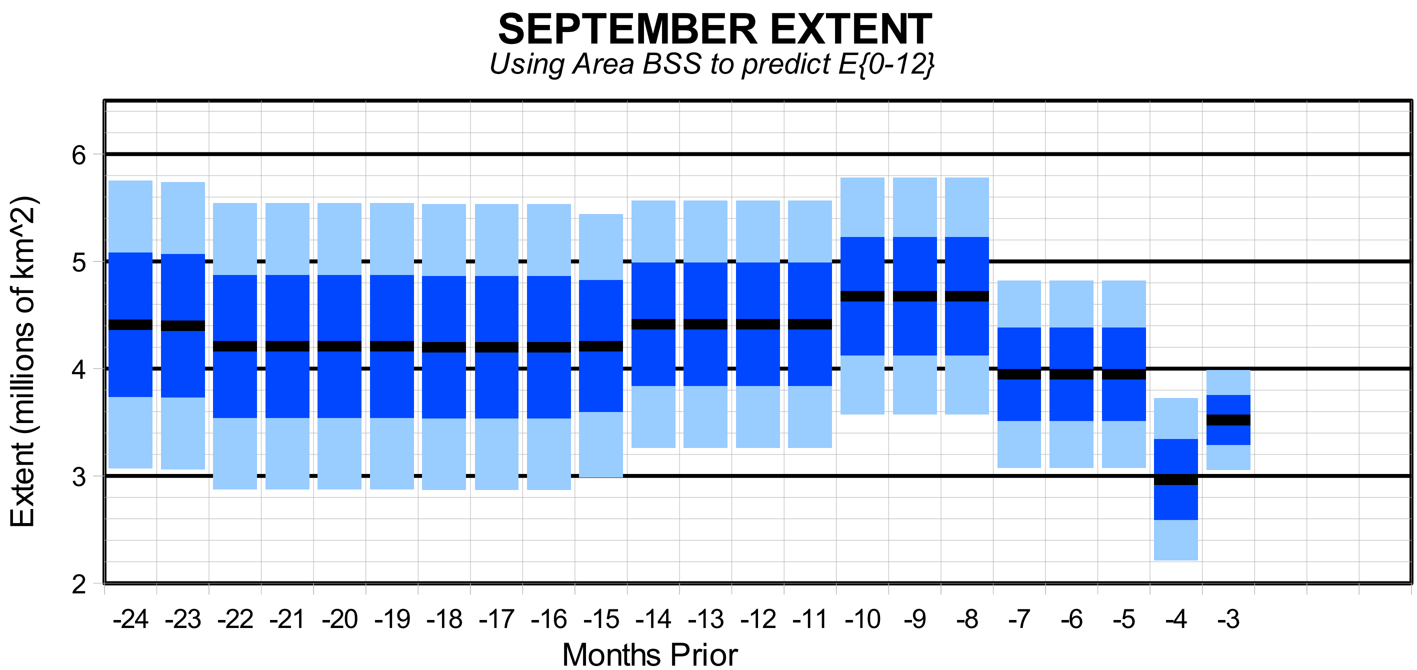
Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E	E BSS	1	-24	5.04	0.62	0.54
E	E BSS	1	-23	5.04	0.62	0.54
E	E BSS	2	-22	4.77	0.55	0.63
E	E BSS	2	-21	4.55	0.55	0.63
E	E BSS	2	-20	4.74	0.53	0.65
E	E BSS	3	-19	4.62	0.51	0.67
E	E BSS	2	-18	4.47	0.51	0.69
E	E BSS	2	-17	4.47	0.51	0.69
E	E BSS	2	-16	4.47	0.51	0.69
E	E BSS	3	-15	4.55	0.48	0.70
E	E BSS	3	-14	4.55	0.48	0.70
E	E BSS	3	-13	4.55	0.48	0.70
E	E BSS	3	-12	4.55	0.48	0.70
E	E BSS	3	-11	4.48	0.47	0.72
E	E BSS	3	-10	4.48	0.47	0.72
E	E BSS	3	-9	4.48	0.47	0.72
E	E BSS	3	-8	4.48	0.47	0.72
E	E BSS	7	-7	4.44	0.35	0.83
E	E BSS	5	-6	4.28	0.38	0.81
E	E BSS	5	-5	4.28	0.38	0.81
E	E BSS	5	-4	4.28	0.38	0.81
E	E BSS	6	-3	4.27	0.35	0.83

Volume BSS

Predicting September Extent



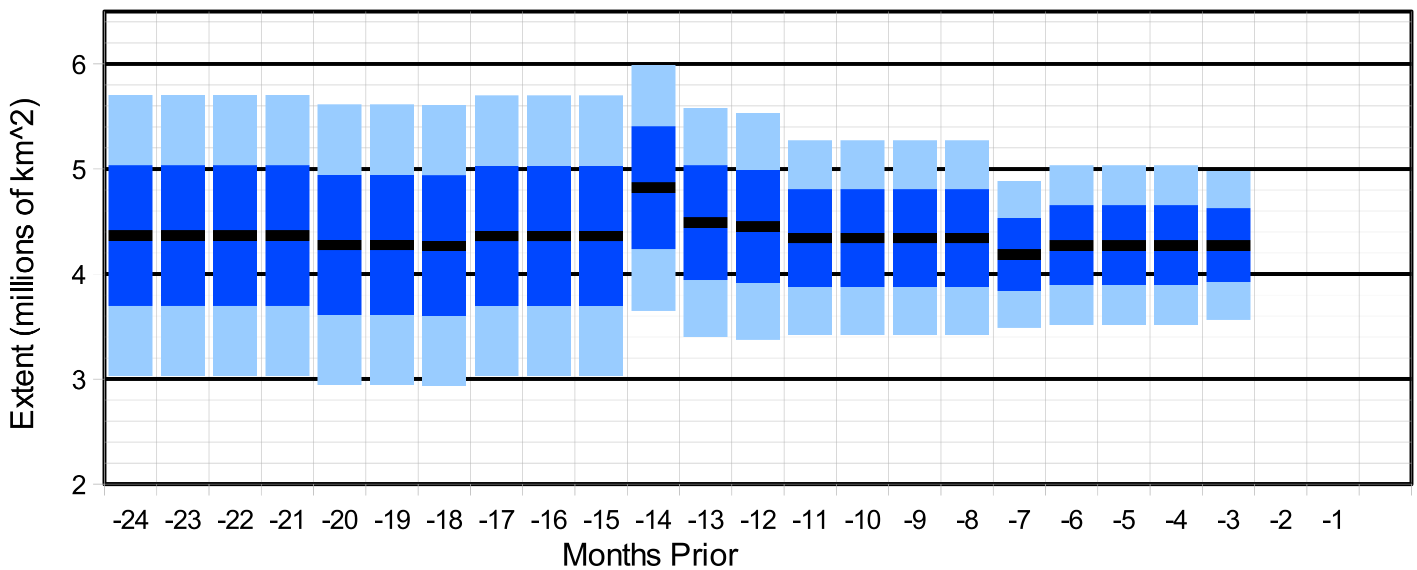
Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E	V BSS	1	-24	4.19	0.53	0.67
E	V BSS	1	-23	4.38	0.52	0.68
E	V BSS	1	-22	4.39	0.51	0.69
E	V BSS	1	-21	4.38	0.50	0.70
E	V BSS	1	-20	4.26	0.49	0.73
E	V BSS	1	-19	4.26	0.49	0.73
E	V BSS	1	-18	4.22	0.49	0.73
E	V BSS	1	-17	4.20	0.49	0.74
E	V BSS	1	-16	4.20	0.49	0.74
E	V BSS	1	-15	4.20	0.49	0.74
E	V BSS	1	-14	4.20	0.49	0.74
E	V BSS	1	-13	4.20	0.49	0.74
E	V BSS	1	-12	4.20	0.49	0.74
E	V BSS	1	-11	4.20	0.49	0.74
E	V BSS	1	-10	4.20	0.49	0.74
E	V BSS	1	-9	4.20	0.49	0.74
E	V BSS	1	-8	4.20	0.49	0.74
E	V BSS	3	-7	3.82	0.44	0.77
E	V BSS	3	-6	3.82	0.44	0.77
E	V BSS	3	-5	4.13	0.42	0.79
E	V BSS	4	-4	4.19	0.36	0.83
E	V BSS	6	-3	3.31	0.28	0.88
E	V BSS					
E	V BSS					



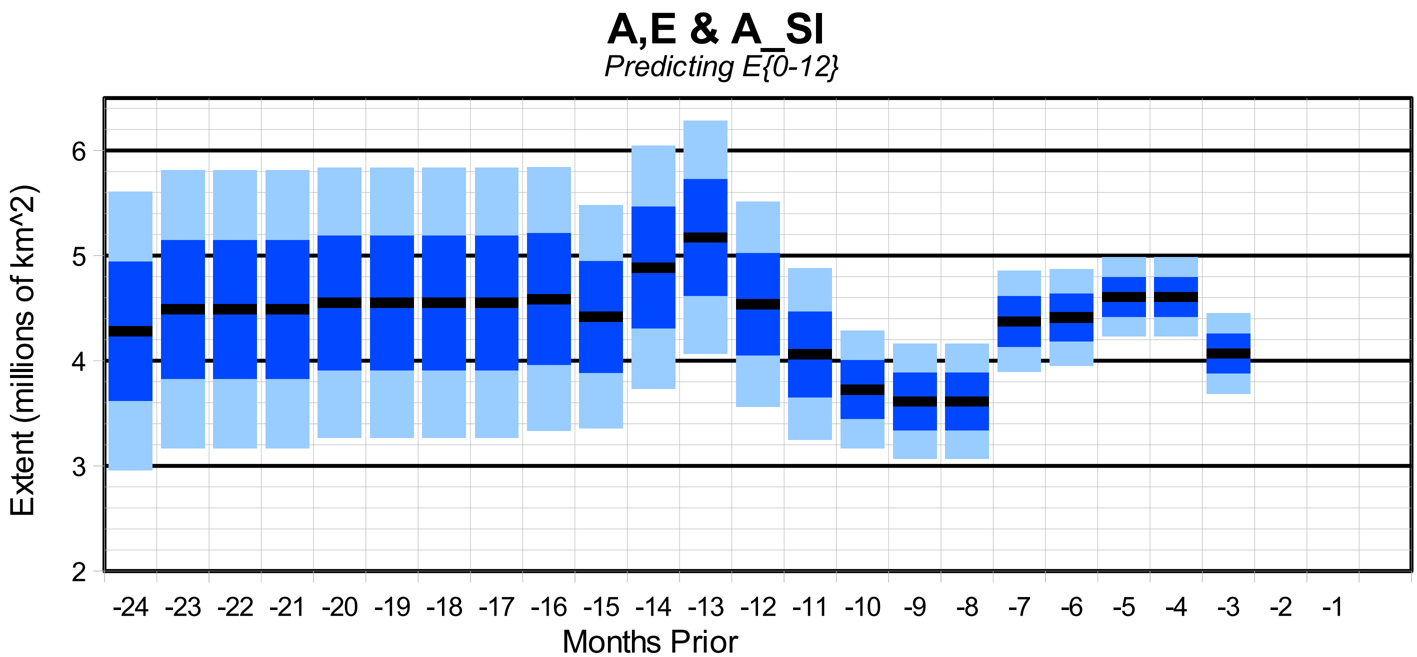
Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E{12}	A BSS	1	-24	4.41	0.67	0.00
E{12}	A BSS	1	-23	4.40	0.67	0.00
E{12}	A BSS	1	-22	4.21	0.67	0.00
E{12}	A BSS	1	-21	4.21	0.67	0.00
E{12}	A BSS	1	-20	4.21	0.67	0.00
E{12}	A BSS	1	-19	4.21	0.67	0.00
E{12}	A BSS	1	-18	4.20	0.67	0.00
E{12}	A BSS	1	-17	4.20	0.67	0.00
E{12}	A BSS	1	-16	4.20	0.67	0.00
E{12}	A BSS	2	-15	4.21	0.61	0.13
E{12}	A BSS	2	-14	4.41	0.58	0.23
E{12}	A BSS	2	-13	4.41	0.58	0.23
E{12}	A BSS	2	-12	4.41	0.58	0.23
E{12}	A BSS	2	-11	4.41	0.58	0.23
E{12}	A BSS	3	-10	4.68	0.55	0.25
E{12}	A BSS	3	-9	4.68	0.55	0.25
E{12}	A BSS	3	-8	4.68	0.55	0.25
E{12}	A BSS	7	-7	3.95	0.44	0.45
E{12}	A BSS	7	-6	3.95	0.44	0.45
E{12}	A BSS	7	-5	3.95	0.44	0.45
E{12}	A BSS	9	-4	2.97	0.38	0.56
E{12}	A BSS	8	-3	3.52	0.23	0.79
E{12}	A BSS				0.22	0.82
E{12}	A BSS				0.17	0.89

Extent Best Subsets

Predicting Annual Change in Extent



Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E{12}	E BSS	1	-24	4.37	0.67	0.00
E{12}	E BSS	1	-23	4.37	0.67	0.00
E{12}	E BSS	1	-22	4.37	0.67	0.00
E{12}	E BSS	1	-21	4.37	0.67	0.00
E{12}	E BSS	1	-20	4.28	0.67	0.00
E{12}	E BSS	1	-19	4.28	0.67	0.00
E{12}	E BSS	1	-18	4.27	0.67	0.00
E{12}	E BSS	1	-17	4.36	0.67	0.00
E{12}	E BSS	1	-16	4.36	0.67	0.00
E{12}	E BSS	1	-15	4.36	0.67	0.00
E{12}	E BSS	2	-14	4.82	0.58	0.22
E{12}	E BSS	2	-13	4.49	0.55	0.32
E{12}	E BSS	2	-12	4.45	0.54	0.33
E{12}	E BSS	4	-11	4.34	0.46	0.45
E{12}	E BSS	4	-10	4.34	0.46	0.45
E{12}	E BSS	4	-9	4.34	0.46	0.45
E{12}	E BSS	4	-8	4.34	0.46	0.45
E{12}	E BSS	8	-7	4.19	0.35	0.63
E{12}	E BSS	6	-6	4.27	0.38	0.62
E{12}	E BSS	6	-5	4.27	0.38	0.62
E{12}	E BSS	6	-4	4.27	0.38	0.62
E{12}	E BSS	7	-3	4.27	0.35	0.65
E{12}	E BSS	9	-2		0.19	0.89
E{12}	E BSS	9	-1		0.13	0.95



Being Fit	Predictors	# of predictors	Most recent	Prediction	RMS	R^2
E{12}	A-SI BSS; A & E	1	-24	4.28	0.66	0.00
E{12}	A-SI BSS; A & E	1	-23	4.49	0.66	0.00
E{12}	A-SI BSS; A & E	1	-22	4.49	0.66	0.00
E{12}	A-SI BSS; A & E	1	-21	4.49	0.66	0.00
E{12}	A-SI BSS; A & E	1	-20	4.55	0.64	0.07
E{12}	A-SI BSS; A & E	1	-19	4.55	0.64	0.07
E{12}	A-SI BSS; A & E	1	-18	4.55	0.64	0.07
E{12}	A-SI BSS; A & E	1	-17	4.55	0.64	0.07
E{12}	A-SI BSS; A & E	1	-16	4.59	0.63	0.08
E{12}	A-SI BSS; A & E	4	-15	4.42	0.53	0.28
E{12}	A-SI BSS; A & E	2	-14	4.89	0.58	0.18
E{12}	A-SI BSS; A & E	2	-13	5.17	0.55	0.27
E{12}	A-SI BSS; A & E	3	-12	4.54	0.49	0.42
E{12}	A-SI BSS; A & E	5	-11	4.06	0.41	0.56
E{12}	A-SI BSS; A & E	9	-10	3.73	0.28	0.75
E{12}	A-SI BSS; A & E	9	-9	3.61	0.27	0.76
E{12}	A-SI BSS; A & E	9	-8	3.61	0.27	0.76
E{12}	A-SI BSS; A & E	11	-7	4.38	0.24	0.80
E{12}	A-SI BSS; A & E	10	-6	4.41	0.23	0.83
E{12}	A-SI BSS; A & E	12	-5	4.61	0.19	0.87
E{12}	A-SI BSS; A & E	12	-4	4.61	0.19	0.87
E{12}	A-SI BSS; A & E	8	-3	4.07	0.19	0.88
E{12}	A-SI BSS; A & E	8	-2			
E{12}	A-SI BSS; A & E	8	-1			